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10.006,306

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Harald S. Gross

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APPLIED MATERIALS, INC.  
2881 SCOTT BLVD. M/S 2061  
SANTA CLARA, CA 95050

EXAMINER

TRAN, BINH X

ART UNIT

PAPER NUMBER

1765

DATE MAILED: 05-19-2003

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/006,306

Applicant(s)

GROSS, HARALD S

Examiner

Binh X Tran

Art Unit

1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 06 December 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☐ Claim(s) 1-32 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☐ Claim(s) 1-24 and 29-32 is/are rejected.
- 7) ☐ Claim(s) 25-28 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4
- 4) ☐ Interview Summary (PTO-413) Paper No(s) \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other

## DETAILED ACTION

### *Claim Objections*

1. Claim 26 is objected to because of the following informalities: In claim 26, the applicants further disclose additional step "f" appears to be a typo for step --e-- since the highest step in claim 21 is step d. Appropriate correction is required.

### *Claim Rejections - 35 USC § 102*

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1-2, 5-6, 10-17, 19-20, 29-30, 32 are rejected under 35 U.S.C. 102(b) as being anticipated by Witek et al. (US 6,146,970).

Respect to claim 1, Witek discloses a method for forming an isolating region comprising:

etching a plurality of trench (210) having a trench opening width, trench opening height and separated by trench wall of some thickness within the silicon structure (Fig 6, col. 6 lines 29-53);

thermally oxidizing the silicon structure (col. 7 line 54-58).

Witek further discloses the silicon oxide layer has a thickness range from 3000-9000 angstrom (equal 3-9  $\mu\text{m}$ , within applicants' range, col. 7 lines 16-19).

Respect to claim 2, Witek discloses a portion of the wall thickness is consumed during the thermal oxidation to provide silicon oxide (212) (Fig 6-7). Respect to claims 5-6, Witek discloses the trench (210) is formed by plasma etching such as reactive ion etching (col. 6 lines 40-45). Respect to claim 10, Witek discloses that the silicon oxide formed on exterior surface (214a and/or 214 b) is selectively removed (col. 7 lines 35-55). Respect to claim 11, Witek discloses the trenches has essentially vertical sidewalls.

Respect to claim 12, Witek discloses:

etching a plurality of opening (210), each opening separated by a nominal distance in the silicon containing structure (Fig 6);

oxidizing the silicon structure (Fig 7, col. 6 lines 49-65).

Respect to claim 13, Witek teaches the opening (210) extends partly through the silicon containing structure (Fig 6). Respect to claim 14, Witek discloses the opening extends completely through a silicon-containing layer (204 and/or 206) in the silicon-containing structure (Fig 6). Respect to claim 15, Witek discloses a portion on the left hand side of the silicon-containing layer or silicon-containing structure is connected to the right hand side of the same by the bridge of unetched silicon (Fig 6). Respect to claim 16, Witek discloses etching at least two openings (210) (See Fig 6). The limitation of claim 17 has been discussed above. Respect to claims 19-20, Witek discloses that

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the silicon oxide formed on exterior surface (214a and/or 214 b) is selectively removed by plasma etching for layer 214a or by polishing for layer 214b (col. 7 lines 35-55).

Respect to claim 29, Witek discloses etching a plurality of openings through the silicon structure, creating a shaped portion (i.e. trench) separated by spokes between the plurality of openings and oxidizing the structure wherein the spokes are converted to silicon oxide (212) which partially fills the etched opening (Fig 6-7, col. 6 lines 35-63).

Respect to claim 30, Witek discloses the openings are completely filled with silicon oxide (216a and 212, Fig 8). The limitation of claim 32 has been discussed above.

4. Claims 12-17, 20 are rejected under 35 U.S.C. 102(e) as being anticipated by Jang et al. (US 6,197,658).

Respect to claim 12, Jang discloses:

etching a plurality of opening (31a, 31b), each opening separated by a nominal distance (W3') in the silicon containing structure (Fig 5);

oxidizing the silicon structure (col. 8 lines 50-65).

Respect to claim 13, Jang teaches the opening (31a, 31b) extends partly through the silicon containing structure (Fig 5). Respect to claim 14, Jang discloses the opening extends completely through a silicon-containing layer (32a-32c, 34a-34c) in the silicon-containing structure (Fig 5). Respect to claim 15, Jang discloses a portion on the left hand side of the silicon-containing layer or silicon containing structure is connected to the right hand side of the same by the bridge of unetched silicon (W3'). Respect to claim 16, Jang discloses etching at least two openings (31a, 31b) (See Fig 5). The limitation of claim 17 has been discussed above. Respect to claims 20, Jang discloses

that the silicon oxide formed on exterior surface (40a-40c) is selectively removed polishing for layer (Fig 8).

***Claim Rejections - 35 USC § 103***

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 3-4, 18, 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Witek in view of Jang (US 6,197,658).

Claims 3-4 differ from Witek by the specific ratio value between the trench opening width with the wall thickness or the specific wall thickness value. Jang ('658) discloses the trenches opening width (W1 and W2) and the wall thickness value (W3) are result effective variable. The result effective variable is commonly determined by routine experiment. The process of conducting routine experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, it would have been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiment to obtain an optimal opening width and wall thickness as an expected result.

7. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Witek in view of Wu (US 6,355,540).

Respect to claim 7, Witek fails to disclose that the reactive action etching is anisotropic etching using fluorine containing etchant component. However, Witek clearly teaches using reactive ion etching (RIE). Wu teaches to use anisotropic RIE

with fluorine-containing etchant component (col. 3 lines 57-65). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Witek in view of Wu by using fluorine-containing etchant component because it is effective component to etch the trench.

8. Claims 8-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Witek in view of Shiozawa et al. (US 6,482,718).

Claims 8-9 differ from Witek by the specific value of aspect ratio. Shiozawa discloses the aspect ratio is a result effective variable range from 1.3 to 4.0 (col. 2 lines 15-36, within applicants' range). The result effective variable is commonly determined by routine experiment. The process of conducting routine experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, it would have been obvious to one having ordinary skill in the art, at the time of invention to perform routine experiment to obtain optimal aspect ratio as an expected result.

9. Claims 21-22, 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jang in view of Peterson et al. (US 6,084,257).

Respect to claim 21, step a through step c has been discussed above under Jang reference. Claims 21-22 differ from Jang by further specifying the step of bonding a plurality of silicon structure to provide at least one continuous oxidized region through said bonded structure. Peterson teaches the step of bonding a plurality of silicon structure to provide at least one continuous oxidized region through said bonded structure using fusion bonding (col. 7 lines 15-45). It would have been obvious to one having ordinary skill in the art, at the time of invention to modify Jang in view of

Peterson by including the step of bonding a plurality of silicon structure because it help to bond the wafers without the use of intermediate glue material. Respect to claim 24, Peterson discloses the multi-layered silicon structure include oxide or nitride layer (read on stress release layer).

10. Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jang in view of Peterson and further in view of Najafi et al. (US 6,338,284)

Peterson fails to disclose eutectic bonding process. However, Peterson clearly discloses a fusion bonding process. Najafi disclose that either fusion bonding or eutectic bonding can be use to attach different substrate. It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Jang and Peterson in view of Najafi by using eutectic bonding process because equivalent and substitution of one for the other would produce an expected result.

#### ***Allowable Subject Matter***

11. Claims 25-28 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

#### ***Conclusion***

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Binh X Tran whose telephone number is (703) 308-1867. The examiner can normally be reached on Monday-Thursday and every other Friday.

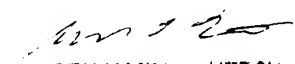


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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin L Utech can be reached on (703) 308-3836. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

Binh X. Tran  
May 14, 2003

  
BENJAMIN L. UTECH  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 1700